

Mapping and digitization of the flow of wind turbine blades



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2022-10-24



Goal & Agenda

Goal:

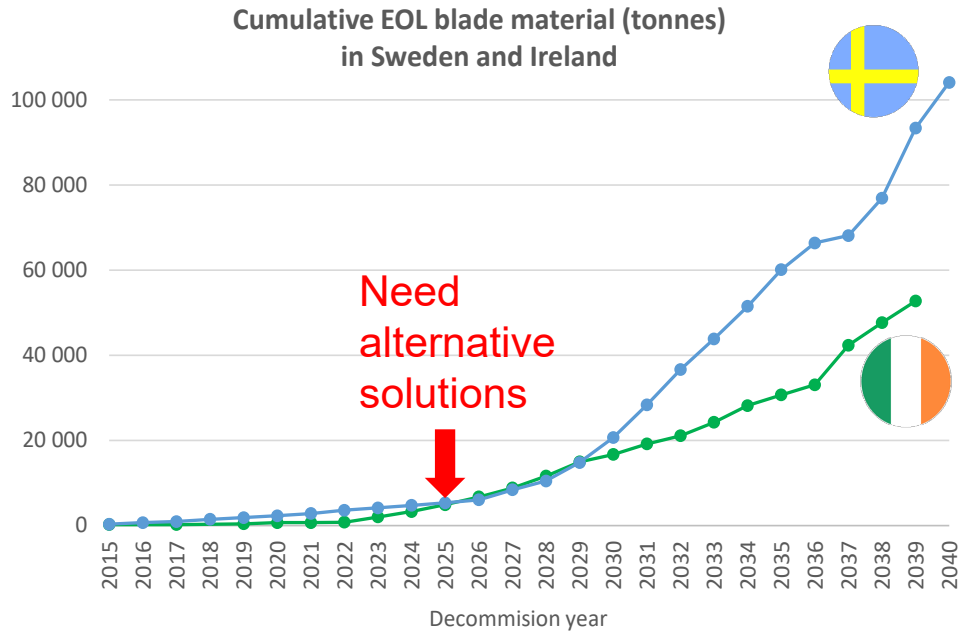
- Develop a circular economy solution through the re-use of end-of-life wind turbine blades
- Create a connected platform with focus on logistics, and mechanical design

Agenda:

- Background
- Digitalization of wind blade streams
- Build an intelligent platform to re-use wind turbine blades
- Challenges and next steps

Background

Estimation of End Of Life (EOL) wind turbines in Sweden



EOL wind turbines 2021-2025



EOL wind turbines 2026-2030



EOL wind turbines 2031-2035



The number of wind turbines blades reaching their end-of-life is growing exponentially

Recycling does not seem like a 100% viable solution

We need alternatives....

Examples of re-purpose of wind turbines



WIKADO

“a playground with added value and a **smaller ecological footprint** built for the **same price** as a comparable standard playground”

Source: <https://re-use.eu/blade-made/>

Examples of re-purpose of wind turbines



ReWind Rotterdam
a seating with iconic quality

Source: <https://re-use.eu/blade-made/>

Examples of re-purpose of wind turbines

First and second - pedestrian and bicycle bridges "BladeBridge"

Anmet (Szprotawa, Poland, oct. 2021)



- First bridge of its kind in the world
- 24 m long
- Main challenge **get approval from authorities.**

Re-Wind Network (Cork, Ireland, feb. 2022)



- Second bridge of its kind in the world
- 5 m long and 3 m wide
- One challenge to know **where** and **when** the blades are decommissioned

Goal: re-purpose at scale

Build a digital platform where all necessary data is available for anyone at anytime

1. How can we know **where** and **when** the blades will be decommissioned?
2. How can we connect blade owners with interested actors?

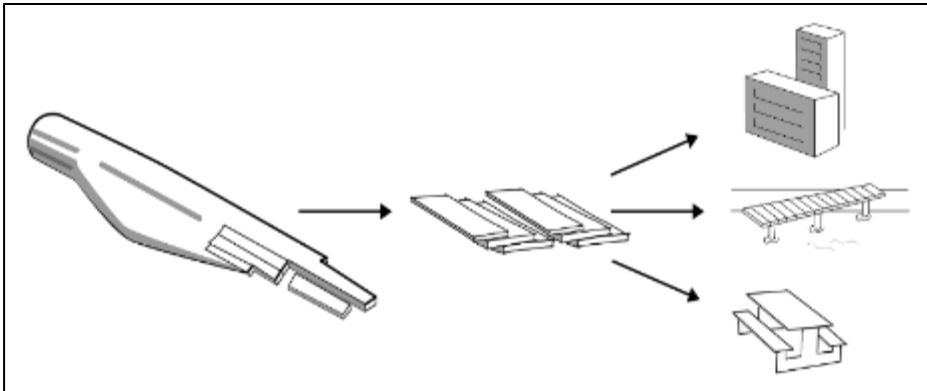


Only a few studies digitalization of wind blade streams

Recycling and re-purpose need more information of “existing old blades” in use:

1. Blade dimensions
2. Material composition
3. Geographical location
4. Decommission date

For optimizing of new future value chains of second life usage of “old blades”



Ireland

Resources, Conservation and Recycling
Volume 170, July 2021, 105601

ELSEVIER

Full length article

An integrated geospatial approach for repurposing wind turbine blades

Emma L. Delaney^{1,2}, Jennifer M. McKinley³, Will Bank⁴, Russell Gentry^{4,5}

China

Resources, Conservation and Recycling
Volume 169, June 2021, 105523

ELSEVIER

Full length article

Modeling waste generation and end-of-life management of wind power development in Guangdong, China until 2050

USA

Thesis Full-text available

Assessment of Present/Future Decommissioned Wind Blade Fiber-Reinforced Composite Material in the United States

May 2016

Thesis for: BS · Advisor: Lawrence C. Bank

Lawrence C Bank · Franco R. Arias

Steps to build a connected platform

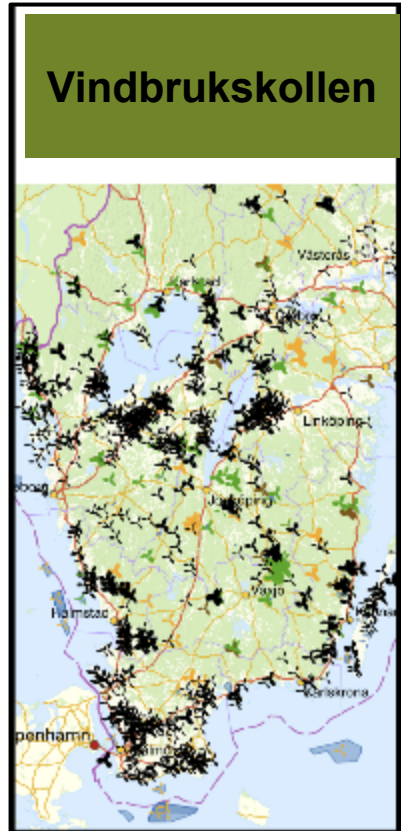
1. Manual mapping of wind turbine blades by wind farm owners in Sweden using the Vindbrukskollen database (<https://vbk.lansstyrelsen.se/en>)
2. Construction of a database of wind turbine blades in operation in Sweden
3. Evaluation of different concepts for reuse with focus in pedestrian bridges
4. Building a database of suitable “cutting concepts” for the reuse of wind turbine blades
5. Prediction of areas with great potential to build future business opportunities for blade re-use



Data collection

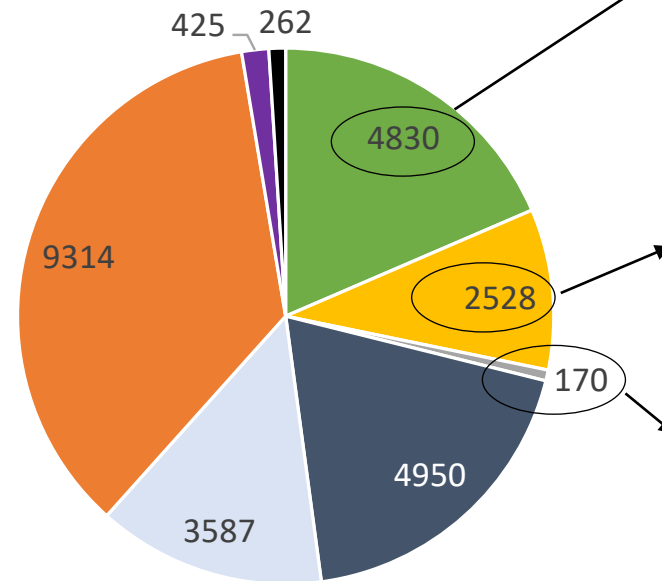
Assumption:

Average service life = 20 years



Breakdown of the 26066 wind turbines registered in Vindbrukskollen

- erected
- approved
- disassembled
- handläggs
- refusal
- not current or revoked
- appealed
- data not available



Erected

erected before 2001	386
erected 2001-2020	3958
erected after 2020	458

Approved

decision 2001-2020	2414
decision after 2020	5
no decision date	109

Disassembled

erected 2001-2020	39
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26 066 wind turbines referenced

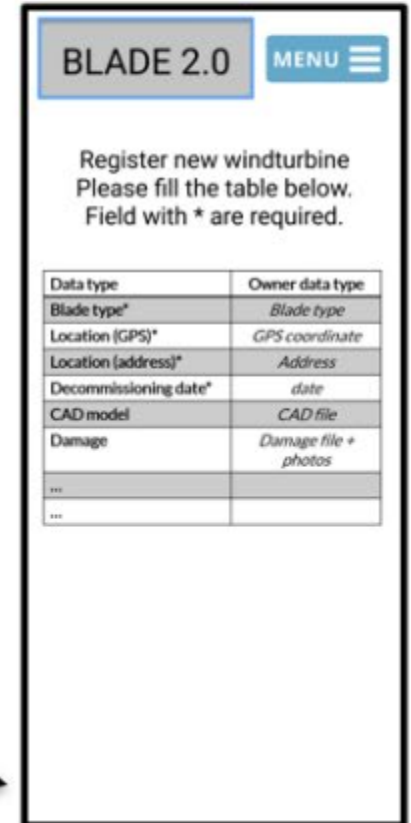
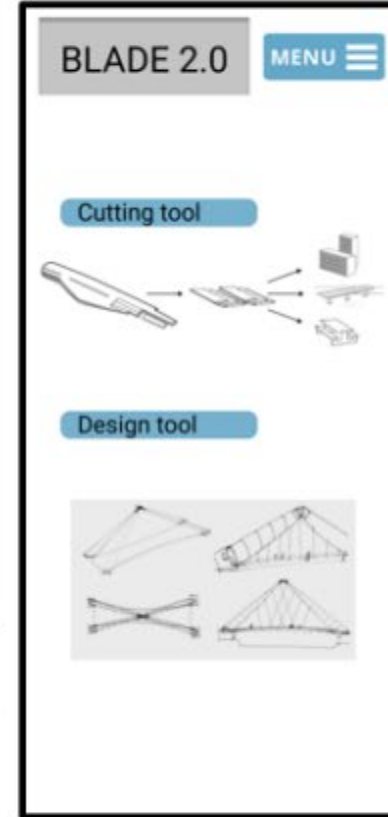
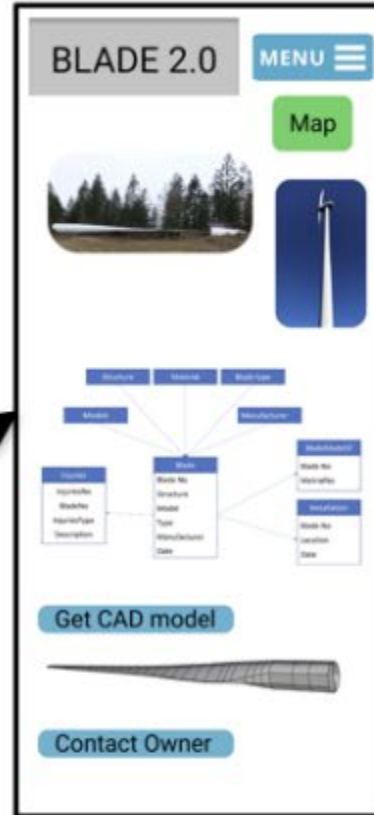
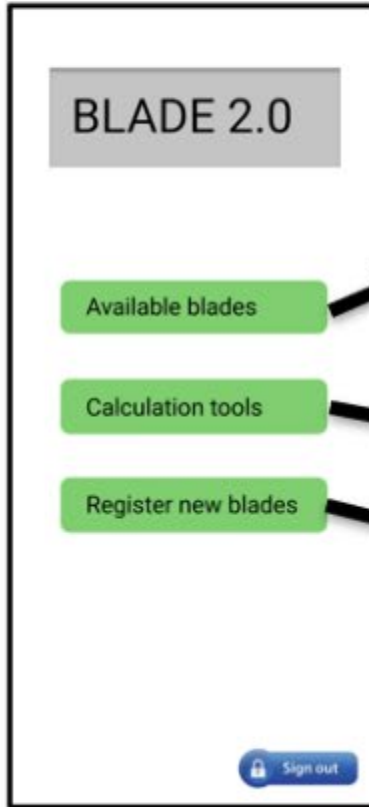
≈4000 wind turbines considered in this study (decommission from 2021 to 2040)

Contact wind turbines owners to complete information about the blades

Design of an user interface



Mock-up
using Figma



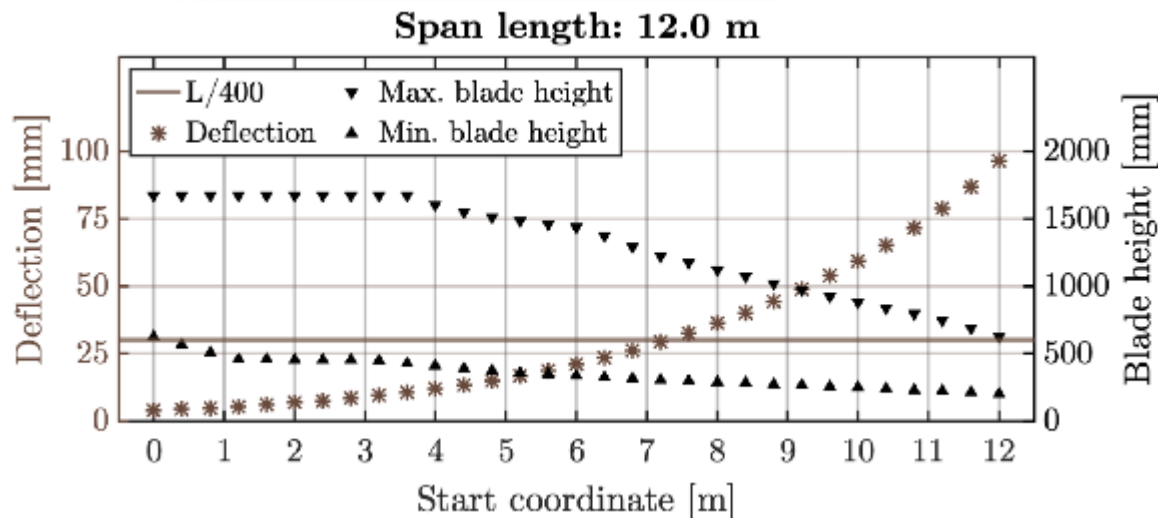
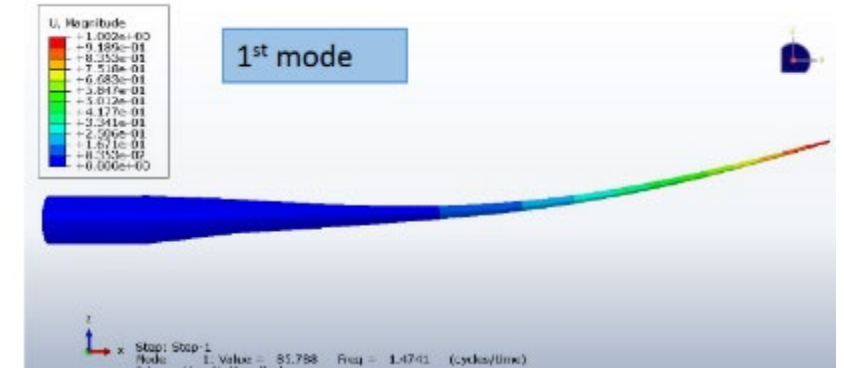
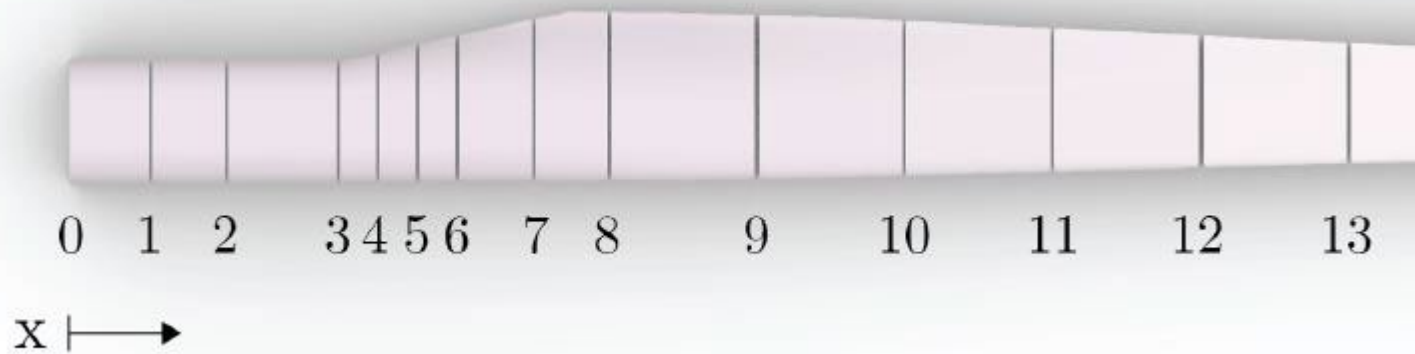
Structural information and quality assessment

1. Understand the structure of the blade
2. Obtain the dimensions
3. Damage inspection
4. Approximate material properties
5. Collect all the data into the platform
6. Use the platform to obtain the right blade in the right place
7. Determine the cutting locations

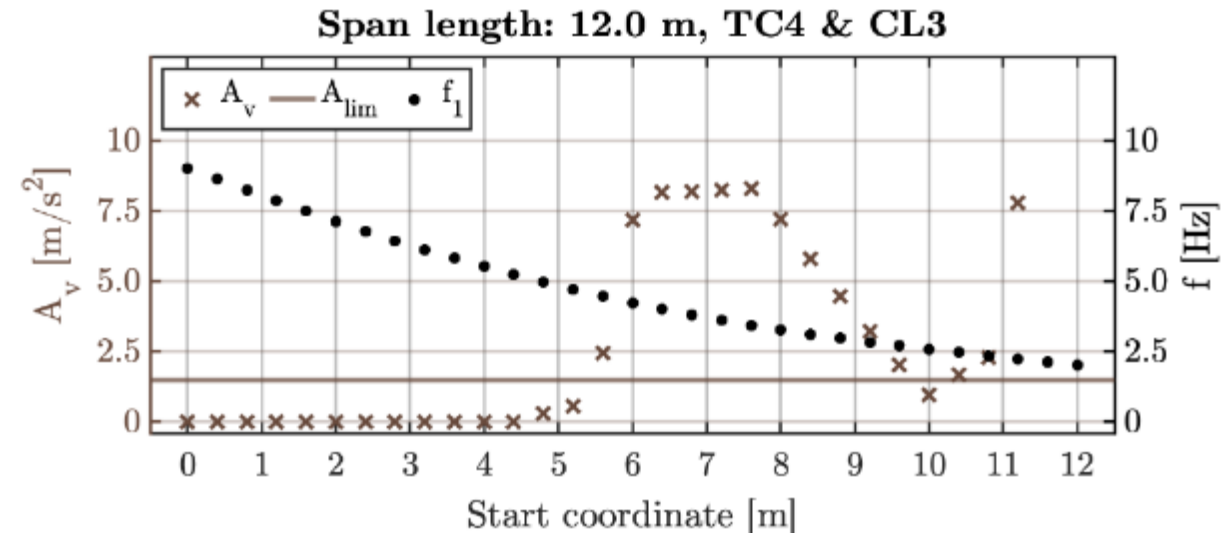


Determine cutting sections via parametric study

Structural analysis of decommissioned blades in pedestrian bridges

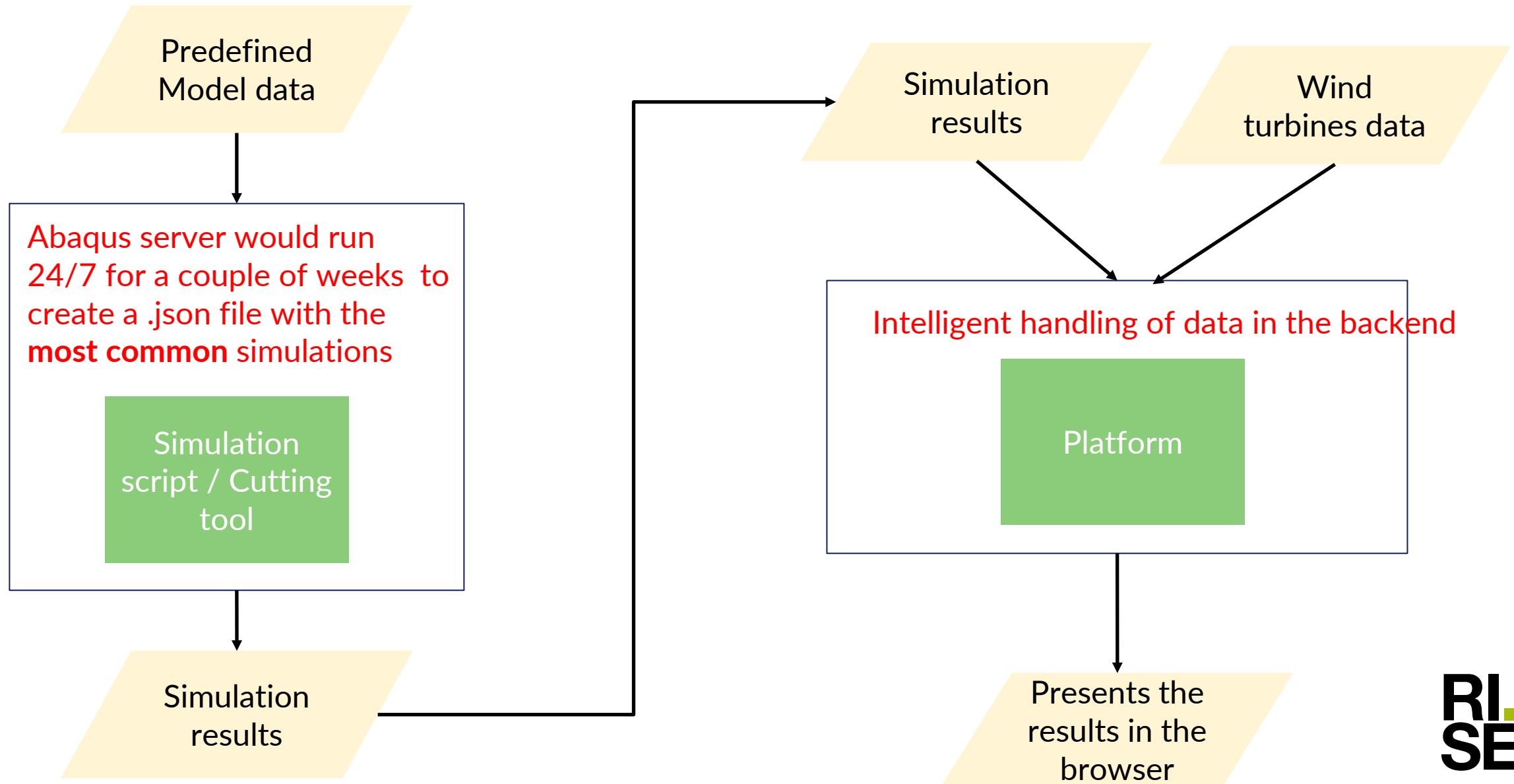


Deflection & max and min blade height



Eigenfrequency and acceleration

How to integrate the structural simulations in the platform





Welcome to BLADE 2.0



Conclusions

- The large scale of wind turbines being decommissioned in the coming years require new circular approaches
- Platforms have revolutionized industries, so a well thought platform is needed for turbine blades
- We started to design & build a platform to connect blade owners with interested actors (users + data + online)
- **We need data from** blade owners to be able to perform structural simulation for pedestrian bridges

There is a lot of work to be done... Get in touch!

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THANK YOU!

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Rekovind2

Digitization of wind blade streams
before reuse and recycling

RI.
SE



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